



First record of African Hind, *Cephalopholis taeniops* (Valenciennes, 1828) (Perciformes, Epinephelidae) in the South-western Atlantic

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Abstract

Recent studies reported the introduction of non-native species on the Brazilian coast. In this contribution, we provide the first record of *Cephalopholis taeniops* (Valenciennes 1828) in the western South Atlantic, based on a specimen captured off the Ilhas Cagarras, Rio de Janeiro, Brazil, and discuss the potential agents for its introduction. While this single specimen was collected in 2006 in a well-known locality, no other specimen has been captured since.

Key words

Brazil; grouper; introduced species; reef fish; Brazilian economic exclusive zone.

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Introduction

The family Epinephelidae (sensu Smith and Craig 2007) currently includes 4 subfamilies (Diploprioninae, Epinephelinae, Liopropominae and Grammistinae). In Brazilian waters, the family Epinephelidae is represented by 25 species and 11 genera (Menezes et al. 2003). The genus *Cephalopholis* has 24 valid species distributed in tropical and subtropical regions of the Atlantic, Indian and Pacific oceans, and differs from other genera by having 9 dorsal-fin spines and caudal fin convex to rounded (Heemstra and Randall 1993, Nelson et al. 2016). Four species of the genus inhabit the Atlantic Ocean, *C. cruentata* (Lacepède, 1802) and *C. fulva* (Linnaeus, 1758) in the Western Atlantic, and *C. nigri* (Günther, 1859) and *C. taeniops* (Valenciennes, 1828) in the Eastern Atlantic (Heemstra and Randall 1993, Craig et al. 2011). Only *C. fulva* is known to occur in Brazilian waters (Menezes et al. 2003).

Only a few epinephelids have been reported on both sides of the Atlantic Ocean: *Alphestes afer* (Bloch, 1793), *Epinephelus adscensionis* (Osbeck, 1765), *Epinephelus itajara* (Lichtenstein, 1822), *Epinephelus marginatus* (Lowe, 1834), *Paranthias furcifer* (Valenciennes, 1828), and *Rypticus saponaceus* (Bloch and Schneider, 1801) (Menezes et al. 2003, Heemstra and Anderson 2016). Here we present the first record of *Cephalopholis taeniops* for the south-western Atlantic, and discuss its putative ways of introduction.

Methods

Measurements and meristic counts follow Heemstra and Randall (1993). Data obtained from the specimen of *Cephalopholis taeniops* of this study matched the measurements and meristic data provided by Heemstra (1991), Ben Abdallah et al. (2007), Salameh et al. (2009)

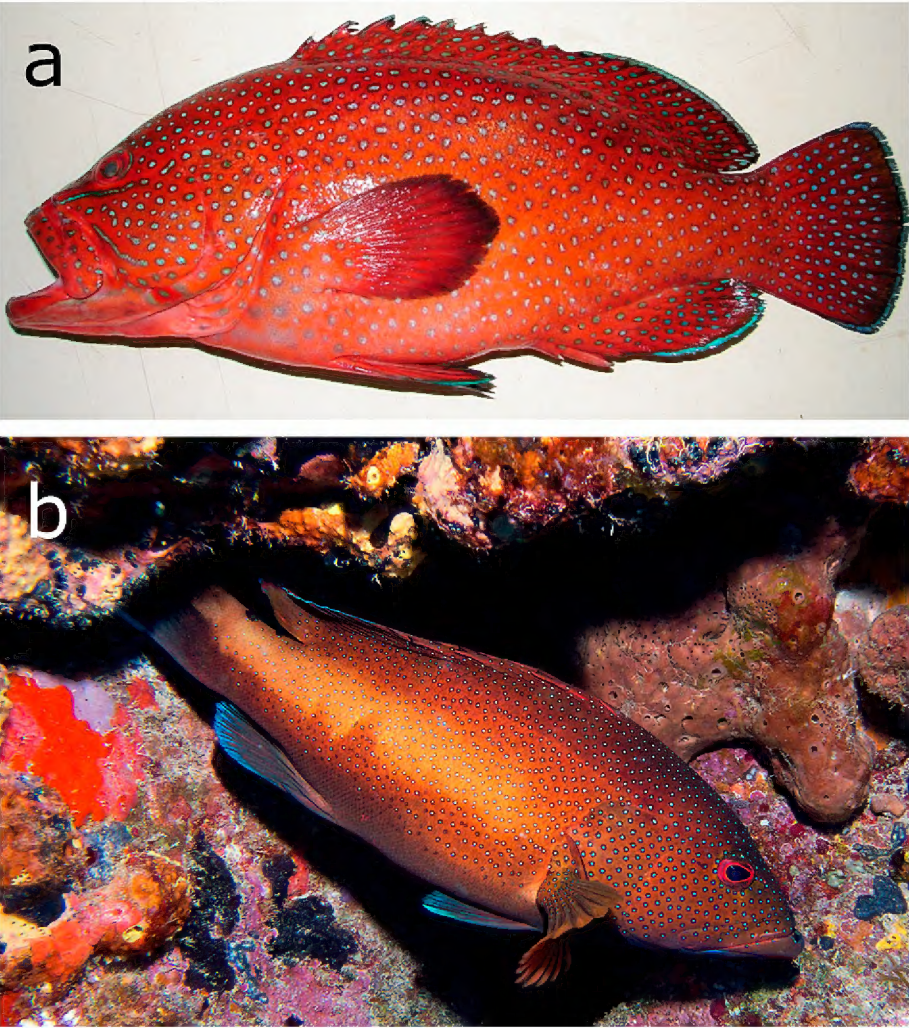


Figure 1. *Cephalopholis* species from the Brazilian coast. **a.** *C. taeniops* fresh specimen, MNRJ 51289, 265.7 mm SL. **b.** *C. fulva* live specimen from Fernando de Noronha (photograph by Marcelo Melo).

and Vella et al. (2016). *Cephalopholis fulva* data was obtained from preserved specimens. Acronym MNRJ stands for Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.

List of comparative material examined: *Cephalopholis fulva*: MNRJ 9654 (10, 53.3–102.8 mm SL) Brazil, Pernambuco, Rio Formoso, Baía de Tamandaré, S. Ypiranga Pinto, August 1959. MNRJ 10680 (2, 150.3–171.4 mm SL) Brazil, Bahia, Recife de Timbebas, D. F. Moraes Jr, 1979. MNRJ 11867 (1, 59.7 mm SL) Brazil, Rio Grande do Norte, Ilha do Farol, Atol das Rocas, G. W. Nunan and D. F. Moraes Jr, between 23 February to 11 March 1982. MNRJ 18781 (4, 145.1–162.6 mm SL) Brazil, coast of Bahia, O. Gripp, 1943. MNRJ 18782 (9, 120.8–188.9 mm SL) between Paraná and Rio Grande do Sul, Survey of Brazilian Marine Fishes of Commercial Importance, 1944. MNRJ 41868 (1, 246.4 mm SL) Brazil, Rio de Janeiro, Macaé, Ilha de Santana, July 1971. MNRJ 48683 (12, 58.5–180.0 mm SL) Brazil, Rio Grande do Norte, Atol das Rocas, G. W. Nunan and D. F. Moraes Jr, 1982. MNRJ 49469 (2, 103.4–118.5 mm SL) Brazil, Bahia, Morro de São Paulo, D. F. Moraes Jr and C. J. F. Costa, 3 November 2002. MNRJ 50261 (1, 157.6 mm SL) 17°8'S, 36°48'W, 39–65 m depth, R/V Thalassa, 6 July 1999.

Results

New record. MNRJ 51289 (1, 265.7 mm SL) Brazil, Rio de Janeiro, Rio de Janeiro, Cagarras Archipelago, 23°04'28.4" S, 043°11'37.2" W, D. F. Moraes Jr, 31 July 2006 (Figs 1a, 2A).

Table 1. Measurements and counts for *Cephalopholis taeniops* (MNRJ 51289) and 12 specimens of *Cephalopholis fulva* (MNRJ 10680, 18781, 41868, 48683 and 50261) from Brazil. SD = Standard deviation.

Species	C. <i>taeniops</i>	C. <i>fulva</i>		
		Range	Mean	SD
Total length (mm)	317.7	176.2–297.4	212.0	—
Standard length (mm)	265.7	138.2–246.4	166.4	—
Measurements (in % SL):				
Body width	20.5	18.0–22.0	19.9	1.6
Body depth	37.0	34.0–41.0	37.2	1.8
Dorsal-fin base	54.5	48.4–55.6	51.1	1.9
Pelvic-fin length	20.5	18.2–23.4	20.6	1.6
Pelvic-fin base	4.9	3.5–4.5	3.9	0.3
Pectoral-fin length	22.5	25.7–31.3	28.6	1.4
Pectoral-fin base	7.8	6.1–8.5	8.6	1.7
Anal-fin base	19.4	16.7–18.3	17.5	0.6
Caudal peduncle depth	14.2	12.9–14.7	14.6	1.4
Pre-pelvic length	40.1	37.4– 42.6	39.5	1.8
Pre-pectoral length	37.0	34.9– 38.4	36.9	1.1
Pre-dorsal length	36.3	35.3– 40.7	38.3	1.7
Pre-anal length	64.2	67.0–72.2	69.8	1.5
Snout tip to vent	62.6	62.2–67.4	64.6	1.2
Head length	39.1	39.0–44.8	40.8	1.9
Interorbital space	7.3	5.0–7.1	6.3	0.6
Preorbital length	12.4	10.1–11.9	10.9	1.4
Eye diameter	5.6	6.9–8.6	7.5	0.5
Upper jaw length	18.0	18.3–20.9	19	1.2
Lower jaw length	14.3	15.1–18.4	16.7	0.9
Counts:		mode		
Dorsal-fin spines	IX	IX	IX	
Dorsal-fin soft rays	15	15–16	15	
Pelvic-fin spine	I	I	I	
Pelvic-fin soft rays	5	5	5	
Pectoral-fin soft rays	18	17–19	18	
Anal-fin spines	III	III	III	
Anal-fin soft rays	9	9	9	
Lower limb gill rakers	16	16–18	16	
Upper limb gill rakers	8	7–8	7	
Total gill rakers	24	23–25	25	
Lateral-series scales	121	94–97	95	
Lateral-line scales	72	51–54	53	

Identification. *Cephalopholis taeniops* can be diagnosed from the Atlantic congeners by possessing 68–72 lateral-line scales (vs 46–54 in *C. fulva*, 47–51 in *C. cruentata* and 45–50 in *C. nigri*) and 114–122 lateral-series scales (vs 90–97 in *C. fulva*, 69–81 in *C. cruentata* and 73–80 in *C. nigri*) (Heemstra and Randall 1993). In addition, *C. taeniops* can be distinguished from *C. cruentata* and *C. nigri* by the presence of blue spots on head, body and fins of live specimens (vs red spots) and 9–10 anal-fin rays (vs 8 anal-fin rays) (McEachran and Fechhelm 1998, Heemstra and Anderson 2016). The color pattern is most similar to *Cephalopholis fulva* (Figs 1b, 2B), and differs from it by having the caudal fin rounded (vs caudal fin convex), no black spots on the dorsal portion of the caudal peduncle, and on the tip of lower jaw (vs black spots on dorsal portion of caudal peduncle and at tip of lower jaw), dark distal margin of caudal fin in preserved



Figure 2. Preserved specimens of *Cephalopholis* species. **A.** *C. taeniops*, MNRJ 51289, 265.7 mm SL, Cagarras Archipelago, Rio de Janeiro, Rio de Janeiro, Brazil. **B.** *C. fulva*, MNRJ 48683, 180.0 mm SL, Atol das Rocas, Rio Grande do Norte, Brazil.

specimen (vs hyaline margin of caudal fin in preserved specimen), spots on anal fin (vs no spots on anal fin) and the presence of a stout blue line below the eye, and a light blue line on lower jaw (vs lines on head absent).

Description. Morphometric measurements and meristic counts are given in Table 1. Body oblong and slightly compressed. Dorsal profile convex, interorbital concave. Mouth large, oblique, lower jaw projected beyond upper jaw. Premaxilla reaching vertical of middle eye. Upper and lower jaws with 2 canines anteriorly. Upper jaw with 1 band of small sharp teeth, teeth smaller posteriorly. Lower jaw with 3–5 rows of fang-like teeth, teeth on inner row larger than lateral rows. Vomer with V-shaped patch of small teeth, palatine with band of 3 rows of small teeth on each side. Upper margin of operculum convex with 3 flat spines posteriorly. Upper spine of operculum slanted, central spine longest and closer to lower spine than to upper, upper and lower spine covered with scales. Preoperculum roundish, lower margin finely serrated. Nostrils close together in front of the eye, anterior nostril with a tubular membrane, posterior nostril elevated without membrane.

Body covered with small scales. Ctenoid scales restricted to laterals. Lateral line barely visible with scales inconspicuous and separated. Dorsal, anal and caudal fin covered with scales, except on margins.

Spiny part of dorsal fin continuous with soft, origin of dorsal fin at level of vertical passing on posterior margin of operculum, first spine smaller than remaining spines. Membranes between dorsal fin spines incised. Pelvic-fin rays unbranched, inserted slightly posterior to base of pectoral fin, longest ray reaching anus when adpressed against body. Pectoral-fin rays unbranched, origin posterior to head, margin slightly pointed. Anal-fin origin immediately posterior to the anus, second spine longer than remaining spines. Posterior margin of dorsal and anal fins rounded. Caudal fin rounded.

In vivo coloration (based on photography of recently dead specimen): Body orangish red. Blue spots with dark margin evenly distributed on entire body, except on ventral part of head and abdomen, first and second anal-fin spines, distal two-thirds of pectoral fin, and pelvic fin. One light blue line without dark margin on lower jaw. Anterior portion of horizontal arm of preopercle with 2

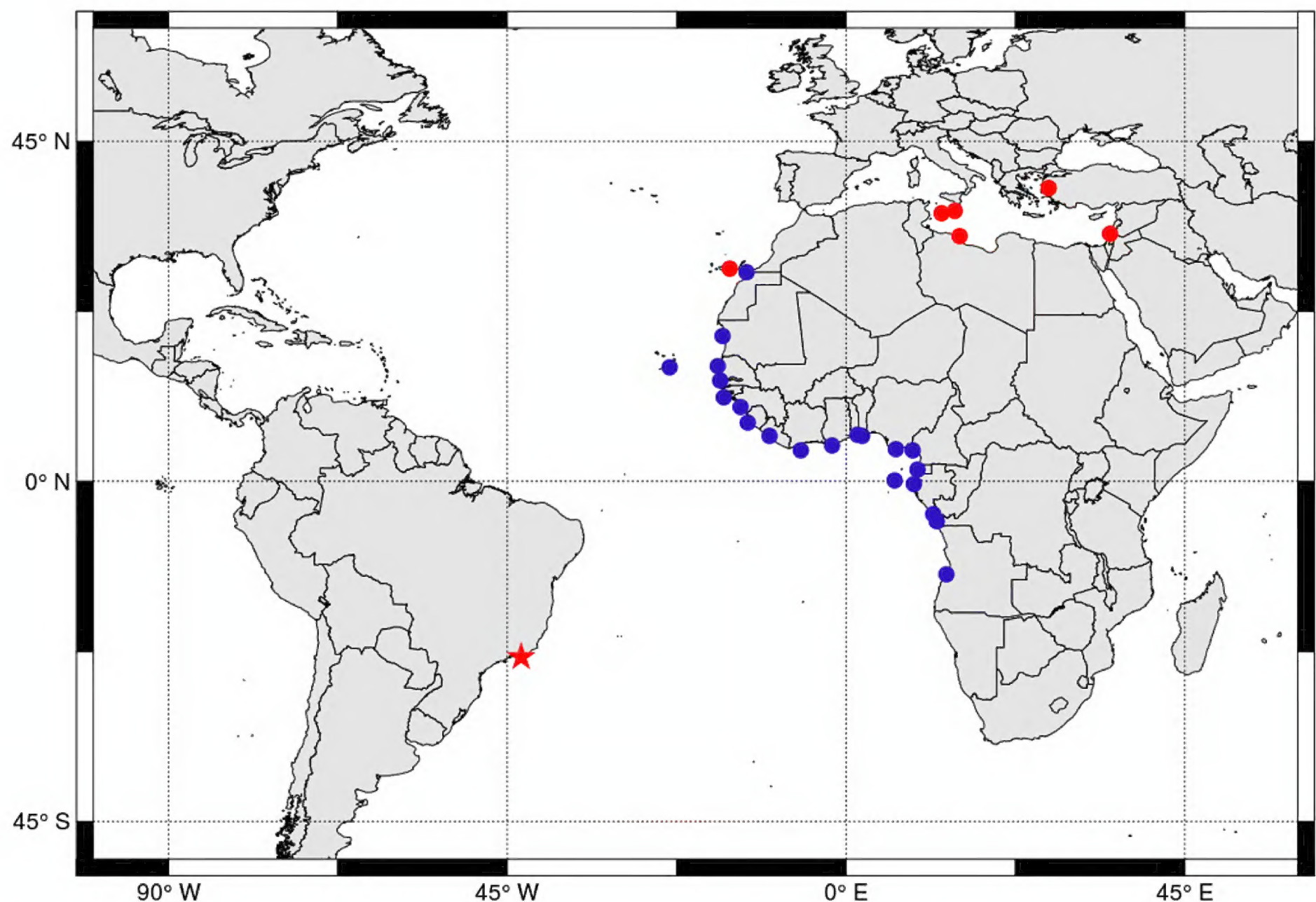


Figure 3. Distribution of *Cephalopholis taeniops*. Natural (blue) and introduced (red) occurrence (Heemstra and Randall 1993, Ben Abdallah et al. 2007, Salameh et al. 2009, Guidetti et al. 2010, Brito et al. 2011, Vella et al. 2016 and Engin et al. 2016). New record (star).

parenthesis-like lines, with a central small spot between them. Eye red with black pupil. Soft portion of dorsal fin, anal, pelvic, and caudal fins with iridescent blue margin.

Preserved specimen coloration: Ground color of body uniformly beige with spots and lines on body, head and fins brown. Pectoral fin beige becoming dark grey posteriorly. Distal margin of soft rays of the dorsal, anal, pelvic and caudal fins black.

Distribution. *Cephalopholis taeniops* naturally occurs in the tropical eastern Atlantic, ranging from Western Sahara to Angola and Cape Verde, São Tomé and Príncipe Islands (Heemstra and Randall 1993). It was recently reported as introduced from several parts of eastern North Atlantic, including the Canary Islands (Brito et al. 2011), and Israel, Lampedusa island, Libya, Malta and Turkey, in the Mediterranean Sea (Ben Abdallah et al. 2007, Salameh et al. 2009, Guidetti et al. 2010, Vella et al. 2016, Engin et al. 2016) (Fig. 3).

Discussion

Few reef-fish species are known to occur natively on both eastern and western Atlantic (e.g. Menezes et al. 2003, Carvalho Filho and Paiva 2017). However, in contrast to the present report of *Cephalopholis taeniops*, amphi-atlantic species usually are collected in more than 1 locality, even for vagrant species (sensu Joyeux et al. 2001). The specimen of *C. taeniops* reported herein was

collected at the Ilhas Cagarras, located circa 4 km from one of the best known urban beaches in Rio de Janeiro (Fig. 3), and a common destination for biologists, scuba dive companies, and local fishermen (Moraes et al. 2013). As a consequence, the ichthyofauna of the archipelago is well known (Rangel et al. 2007, Monteiro-Neto et al. 2013) with studies dating from the beginning of the last century (Miranda-Ribeiro 1903). Thus, it is unlikely that another specimen of *C. taeniops* could pass unperceived. This along with the rarity of cases of natural invasions from Eastern to Western Atlantic (Joyeux et al. 2001) led us to assume it was an anthropogenic introduction. The release of an aquarium specimen is unlikely, since no report of *C. taeniops* imported to Brazil is known, and the importing of the species is not allowed in Brazil (IBAMA 2018). Due to the lack of data on larval stages, it is not possible to determine if this species was introduced through ship ballast water (Carlton 1996).

The incidental transport of this specimen made by an oil platform, which may have functioned as a moving reef, is plausible. This species has been already observed associated to oil platforms in the Canary Islands (Brito et al. 2011, Pajuelo et al. 2016). According to Brito et al. (2011), the transport via oil platform explains how adult specimens of *Cephalopholis taeniops* have arrived in the Canary Islands and the Mediterranean Sea. This hypothesis is also supported by the fact that oil platforms usually are repaired near the Pai and Mãe islands, circa 10 km from the Cagarras Archipelago (Moraes, personal com-

munication, July 26, 2018). The present case resembles the records of *Holacanthus ciliaris* (Linnaeus, 1758) and *Paranthias furcifer* (Valenciennes, 1828) from Adriatic Sea where only 1 specimen was captured coinciding with the arrival of an oil platform (Dulčić and Dragičević 2012, 2013).

Since only a single specimen was captured in 12 years, it indicates that this species was not successful in colonizing the southwest Atlantic. However, future captures of non-native species need to be analyzed and monitored, due to the uncertainty of the impact of these introductions on native species.

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Author's Contributions

LCG identified the species and obtained the measurements and meristic counts; LCG, CRM and ACF wrote, revised and corrected the manuscript.

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